

CLAIMS

1. A hard surface coating composition for use in providing a hydrophilic coating on a surface, said hard surface coating composition comprising:
 - a) a surface modifying agent comprising a plurality of non-photoactive nanoparticles, said nanoparticles being present in an amount effective to provide a residual hydrophilic coating on a surface;
 - b) a carrier, at least some of which is aqueous, and at least some of said aqueous carrier being purified; and
 - c) less than about 10% by weight of other ingredients,wherein said coating composition is non-thixotropic.
2. The hard surface coating composition of Claim 1 which is a liquid when it is in a state of rest.
3. The hard surface coating composition of Claim 2 wherein the effective amount of non-photoactive nanoparticles is less than or equal to about 1% by weight of said composition.
4. The hard surface coating composition of Claim 1 comprising less than or equal to about 5% by weight of said other ingredients.
5. The hard surface coating composition of Claim 1 which is substantially free of polymers.
6. The coating composition according to Claim 1 wherein said non-photoactive nanoparticles are selected from the group consisting of oxides, silicates, carbonates, hydroxides and mixtures thereof.
7. The coating composition according to Claim 1 wherein said non-photoactive nanoparticles are selected from the groups consisting of:
 - a) inorganic metal oxides, natural clays, synthetic clays and mixtures thereof;

- b) synthetic clays selected from the group consisting of kaolinite, montmorillonite/smectite, illite, variants and isomorphous substitutions of said synthetic clay groups and mixtures thereof;
- c) synthetic clays selected from the group consisting of layered hydrous silicate, layered hydrous aluminum silicate, fluorosilicate, mica-montmorillonite, hydrotalcite, lithium magnesium silicate, lithium magnesium fluorosilicate and mixtures thereof.
8. The coating composition according to Claim 7 wherein said synthetic clay is lithium magnesium silicate with the formula:
- $$[\text{Mg}_w \text{Li}_x \text{Si}_8 \text{O}_{20} \text{OH}_{4-y} \text{F}_y]^{z-}$$
- wherein $w = 3$ to 6 , $x = 0$ to 3 , $y = 0$ to 4 , $z = 12 - 2w - x$, and the overall negative lattice charge is balanced by counter-ions.
9. The coating composition according to Claim 8 wherein said lithium magnesium silicate is selected from the group consisting of fluorine substituted variants of lithium magnesium silicate and mixtures thereof.
10. The coating composition according to Claim 1 wherein said hard surface is selected from the group consisting of fiberglass, plastics, metals, glass, dishware, ceramic, wood, stone, concrete, asphalt, mineral, painted and mixtures thereof.
11. The coating composition according to Claim 1 wherein said surfactant is selected from the group consisting of anionic surfactants, cationic surfactants, nonionic surfactants, amphoteric surfactants, zwitterionic surfactants and mixtures thereof.
12. The coating composition according to Claim 11 wherein said nonionic surfactant is selected from the group consisting of $\text{C}_{9/11}\text{EO}_8$ -cyclohexyl acetal alkyl capped nonionic, C_{11}EO_7 -n-butyl acetal, $\text{C}_{9/11}\text{EO}_8$ -2-ethylhexyl acetal, C_{11}EO_8 -pyranyl, alcohol alkoxylate and mixtures thereof.
13. The coating composition according to Claim 1 wherein said non-photoactive nanoparticles have a particle size distribution that falls within the range from about 1 nm

to less than about 400 nm.

14. The coating composition according to Claim 1 wherein said other ingredients comprise adjunct materials selected from the group consisting of photoactive inorganic metal oxides, organic solvents, surfactants, polymers, builders, bleaches, bleach activators, bleach catalysts, non-activated enzymes, enzyme stabilizing systems, chelants, optical brighteners, soil release polymers, wetting agents, dye transfer agents, dispersants, suds suppressors, dyes, perfumes, colorants, filler salts, hydrotropes, photoactivators, fluorescers, conditioners, hydrolyzable cosurfactants, perservatives, anti-oxidants, anti-shrinkage agents, germicides, fungicides, color speckles, silvercare, anti-tarnish and/or anti-corrosion agents, alkalinity sources, solubilizing agents, carriers, processing aids, pigments, and pH control agents.
15. The coating composition according to Claim 1 wherein: said non-photoactive nanoparticles comprise sodium magnesium lithium fluosilicate in an amount less than or equal to about 0.2%; and said other ingredients comprise at least one wetting agent.
16. The coating composition according to Claim 15 wherein said wetting agent comprises a low sudsing surfactant.
17. The coating composition according to Claim 1 wherein an effective amount of photoactive inorganic metal oxides are combined with said effective amount of non-photoactive nanoparticles.
18. A hard surface coating composition comprising:
 - a) a plurality of non-photoactive nanoparticles in an amount effective to modify the characteristics of a surface, said amount being less than about 5% by weight of the composition;
 - b) a carrier, at least some of which is aqueous, and at least some of said aqueous carrier being purified;
 - c) optionally a surfactant; and
 - d) optionally one or more adjunct ingredients;wherein said coating composition is capable of modifying a hard surface to provide at least one of the following multi-use benefits comprising improved: increased speed of

drying, cleaner appearance, enhanced gloss, smoothness, and reduced damage to abrasion and transparency; as compared to the same hard surface not treated with said hard surface coating composition.

19. The hard surface coating composition of Claim 18 wherein said coating composition is also capable of modifying a hard surface to provide anti-spotting and anti-hazing.
20. A method of forming a substantially clear coating on a hard surface, said method comprising:

locating a rigid article having a hard surface;

applying a composition to the hard surface, said composition comprising:

- a) a surface modifying agent comprising a plurality of non-photoactive nanoparticles, said nanoparticles being present in an amount effective to provide a coating on the surface, said amount being less than or equal to about 25 micrograms of nanoparticles per cm^2 of the surface;
- b) a carrier, at least some of which is aqueous, and at least some of said aqueous carrier being purified;
- c) optionally a surfactant; and
- d) optionally one or more adjunct ingredients;

allowing said composition to dry without rinsing or agitating the same so that a substantially clear, hydrophilic coating is formed on said hard surface.

21. The method of Claim 20 wherein the effective amount of non-photoactive nanoparticles is less than about 5% by weight of said composition.
22. The method of Claim 20 wherein said nanoparticles form more than one layer on said hard surface, and at least one of said more than one layer of said hard surface coating is strippable.
23. The method of Claim 20 wherein after drying, the hydrophilicity of said hard surface coating endures more than one rinse.

24. A method of modifying a hard surface to provide said hard surface with multiple modified properties, said method comprising:

locating a rigid article having a hard surface;

applying a multiple benefit providing material for coating a hard surface to the hard surface, said material comprising:

- a) an effective amount of non-photoactive nanoparticles;
- b) a suitable carrier medium;
- c) optionally a surfactant; and
- d) optionally one or more adjunct ingredients; and

allowing said material to cure on said hard surface without rinsing or agitating said material to form a hard surface coating thereon which forms a residual hydrophilic exterior on said hard surface that provides said hard surface with two or more modified properties.

25. The method of Claim 1 wherein said two or more modified properties are selected from the following improved properties: wetting and sheeting, quick drying, uniform drying, soil removal, self-cleaning, anti-spotting, anti-soil deposition, cleaner appearance, enhanced gloss, enhanced color, minor surface defect repair, smoothness, anti-hazing, modification of surface friction, release of actives, reduced damage to abrasion and transparency; as compared to a hard surface not treated with said material.

26. A method of modifying a surface to improve the ability of the surface to dry after the surface has been wetted, said method comprising:

locating an article having a surface, wherein when said surface is untreated, said surface will have a first amount of water remaining thereon ten minutes after said surface has been wetted and allowed to begin drying;

applying a composition to said surface, said composition comprising:

- a) a surface modifying agent comprising a plurality of non-photoactive

nanoparticles, said nanoparticles being present in an amount effective to improve the ability of a surface to dry after said composition has been applied thereto;

- b) a suitable carrier medium;
- c) optionally a surfactant; and
- d) optionally one or more adjunct ingredients,

allowing said composition to dry without rinsing or agitating the same, wherein after said composition has dried on said surface, said surface is wetted it has a second amount of water remaining thereon ten minutes after said surface has been wetted and allowed to begin drying, wherein said second amount of water remaining on said treated surface is less than the first amount of water remaining on said untreated surface.

27. The method of Claim 26 wherein the treated surface has a lower contact angle with water than the untreated surface.
28. A process for providing an article having a hard surface with an improved ability to have soil deposited thereon to thereafter be removed from said surface, said process comprising:
 - (a) locating an article having a surface;
 - (b) washing the surface of said article;
 - (c) optionally rinsing the surface of said article;
 - (d) coating the surface of said article with a coating composition comprising a plurality of non-photoactive nanoparticles, said nonparticles being present in an amount effective to provide a coating on said surface, wherein the amount of said nanoparticles applied to said surface is less than about 5% by weight of said composition in the form in which it is applied to said surface whether it be diluted or undiluted; and
 - (e) allowing said coating composition to dry without rinsing or agitating the same so that said nanoparticles in said coating composition deposit onto the surface of said article, and at least some of said nanoparticles remain on said surface.
29. The process of Claim 28 wherein said nanoparticles deposited on said surface form a

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39. The method of Claim 37 wherein said surface of the article reflects colored light to a greater extent after the method has been performed than said surface before it has been coated with said coating composition.
40. The method of Claim 37 wherein said surface has an initial coefficient of friction with a second material before said method is performed, and a second coefficient of friction with the second material after the method has been performed, and said second coefficient of friction is lower than said first coefficient of friction.
41. The method of Claim 40 wherein said article is of a type that moves, and said second material is air or water.
42. The method of Claim 40 wherein said article is of a type that is stationary, and said second material moves relative to said article.
43. The method of Claim 37 wherein the surface of the article has defects therein, and the method repairs at least some of said defects in said surface.
44. A method of forming a transparent, protective coating on a hard surface, said method comprising:
- locating a rigid substrate with a hard surface;
- coating the surface of said substrate with a hard surface coating composition, said hard surface coating comprising a plurality of non-photoactive nanoparticles, wherein said non-photoactive nanoparticles comprise sodium magnesium lithium fluosilicate; and
- allowing said coating composition to dry without rinsing or agitating the same so that at least some of said nanoparticles in said coating composition form a transparent, protective coating on said hard surface.
45. The method of Claim 44 wherein said transparent, protective coating protects said hard surface from damage due to abrasion.
46. A method for cleaning the surface of an article and applying a coating to said surface,

said method comprising:

- (a) locating an article having a surface to be cleaned;
- (b) washing the surface of said article;
- (c) rinsing the surface of said article;
- (d) coating the surface of said article with a coating composition comprising a plurality of non-photoactive nanoparticles; and
- (e) allowing said coating composition to dry without rinsing or agitating the same so that at least some of said nanoparticles in said coating composition deposit onto the surface of said article.

- 47. A method according to one of Claims 20 or 46 wherein said non-photoactive nanoparticles are of a type that form a substantially complete coating on said surface.
- 48. A method according to one of Claims 20 or 46 wherein said non-photoactive nanoparticles comprise sodium magnesium lithium fluosilicate in an amount less than or equal to about 0.2%, and said composition further comprises at least one wetting agent.
- 49. A method according to Claim 20 or 46 wherein said wetting agent has a contact angle with water of less than or equal to about 20°.
- 50. A method according to one of Claims 20 or 46 wherein said wetting agent comprises a low sudsing surfactant.
- 51. The method of Claim 46 wherein the step (c) of rinsing the surface of the article comprises rinsing the surface with at least some purified water.
- 52. The method of Claim 46 wherein the coating composition applied in step (d) further comprises water.
- 53. The method of Claim 46 wherein the nanoparticles that deposit onto the surface of said article form a residual hydrophilic surface.
- 54. The method of Claim 46 wherein after said coating composition has dried, at least some

of said nanoparticles remain on said surface after said surface has been contacted with water.

55. A method for modifying a hard surface to increase the receptivity of said hard surface to the subsequent application of a substance, said method comprising:

locating a substrate with a surface;

depositing a surface modifying agent comprising a plurality of non-photoactive nanoparticles on the surface of said substrate, said nanoparticles having surfaces, wherein said surface with said nanoparticles thereon has increased receptivity to certain other substances relative to the surface of said substrate without said nanoparticles thereon; and

depositing one or more functionalized surface molecules onto the surfaces of at least some of said nanoparticles.

56. The method of Claim 55 wherein said functionalized surface molecules exhibit properties selected from the group consisting of: hydrophilic, hydrophobic, and mixtures thereof.

57. The method of Claim 55 wherein said functionalized surface molecules are selected from the groups consisting of:

- a) monomeric materials, polymers, copolymers and mixtures thereof; wherein at least one segment or group of said monomeric material or polymer comprises functionality that serves to anchor or enhance adsorption on nanoparticle surfaces; and wherein at least one segment or group that serves to provide either hydrophilic or hydrophobic character to said polymer when adsorbed on a nanoparticle;
- b) ethoxylated oligoamines, ethoxylated and quaternized oligoamines, ethoxylated, quaternized and sulfated oligoamines, ethoxylated and sulfated oligoamines, ethoxylated oligoamines which have been converted to sulfobetaine or betaine and mixtures thereof;
- c) polycarboxylate copolymers with unsaturated monomers, polymethacrylates, polymaleates, polyfumarates, copolymers and mixtures thereof;

d) multi-valent inorganic salts consisting of Ca^{+2} , Mg^{+2} , Ba^{+2} , Al^{+3} , Fe^{+2} , Fe^{+3} , Cu^{+2} and mixtures thereof; and wherein an appropriate anion is used to balance the charge of said nanoparticle; and

e) at least two different types of the foregoing functionalized surface molecules.

58. A composite structure with a hydrophilic surface, comprising:

a rigid substrate having a hard surface; and

a hard surface coating adhered to the surface of said substrate, said hard surface coating comprising a plurality of non-photoactive nanoparticles in an amount less than or equal to about 25 micrograms/cm² of the surface, said hard surface coating providing the composite structure with a hydrophilic surface.

59. The composite structure of Claim 58 wherein said substrate is more rigid than a synthetic resin film which has a thickness of 0.1 mm.

60. The composite structure of Claim 58 wherein the surface of said substrate is an exterior surface.

61. The composite structure according to Claim 58 wherein said plurality of non-photoactive nanoparticles are arranged in the form of at least one layer.

62. The composite structure according to Claim 58 wherein at least some of said non-photoactive nanoparticles remain on said surface after said surface is contacted with water.

63. An article of manufacture comprising an applicator comprising a spray dispenser, an immersion container, a hose spray dispenser attachment, a fabric or a porous article; said article of manufacture further comprising:

a) a coating composition according to Claim 1, wherein said coating composition is contained within said applicator;

- b) optionally a source of deionized water;
- c) optionally a source of tap water; and
- d) optionally a set of instructions in association with said spray dispenser comprising an instruction to dispense said coating composition from said spray dispenser onto a hard surface to modify said hard surface.

64. The article of manufacture of Claim 63 wherein said spray dispenser is selected from the group consisting of: a diluting spray dispenser; a trigger spray device, and other manually operated spray dispensers, and non-manually operated spray dispensers, wherein said non-manually operated spray dispenser is selected from the group consisting of: powered sprayers; air aspirated sprayers; liquid aspirated sprayers; pneumatic sprayers; electrostatic sprayers; and nebulizer sprayers.
65. The article of manufacture of Claim 63 in association with instructions for use, wherein said instructions for use direct the consumer to allow said coating composition to dry without rinsing or agitating the same.
66. A method according to Claim 46 wherein said article is a vehicle, and said method is carried out at a facility for washing vehicles.